

## 10 Melvern Lake

### 10.1 General Background

Melvorn Lake was impounded on 1 August 1970 and reached full multipurpose pool on 4 April 1975. The primary water quality threats to the lake include nutrients, herbicides, bacteria and sedimentation. Approximately 80% of the watershed landuse is grazing, hay or native vegetation, while the remaining 20% is cropland. Soils within the watershed are shallow but high in phosphorus content. The Melvern Lake Water Quality Project was started approximately five years ago, with the specific goals to improve water quality in the lake and tributaries and to reduce nonpoint source pollutants to the lake, tributaries and groundwater. This EPA 319 grant funded project is a cooperative effort between local, state, and federal agencies.

#### 10.1.1 Location

A dam located on the Marais des Cygnes at river mile 175.4 (280.6 km) impounds Melvorn Lake. The dam is approximately 6.4 km (4 miles) west of Melvern. The watershed is located in Lyon, Osage, Wabaunsee, and Coffey Counties. Historic water quality sample sites at Melvern include 3 lake, 1 outflow, and 1 inflow (Figure 10.1).

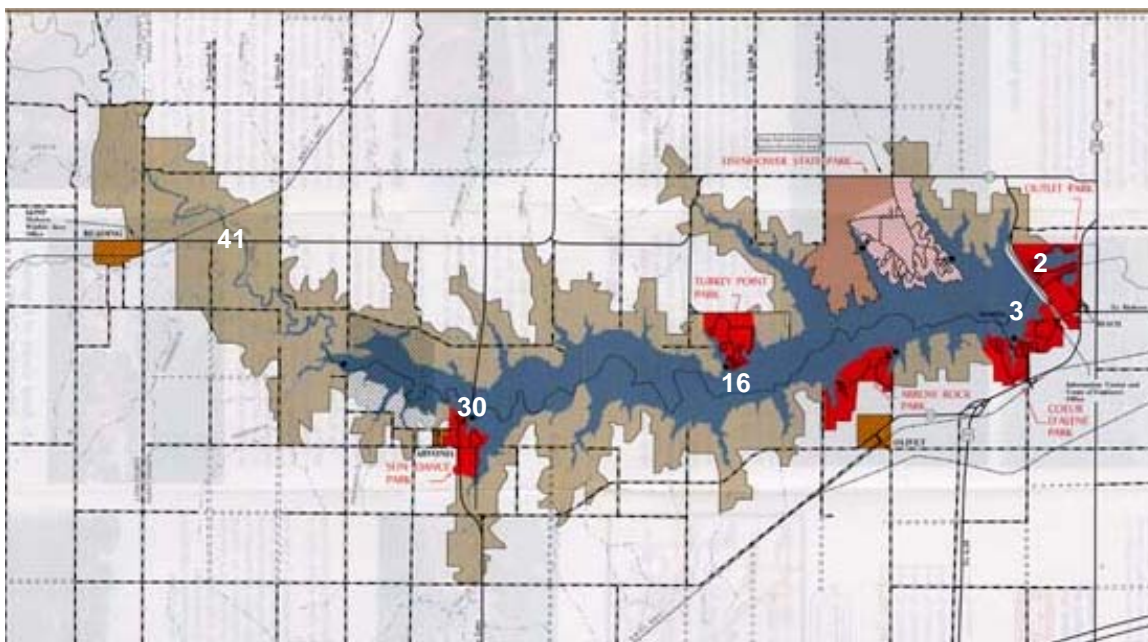


Figure 10.1. Melvorn Lake area map with sample site locations and site numbers.

**10.1.2 Authorized Purposes:** Flood damage reduction, recreation, fish and wildlife management, water supply, and water quality improvement.

#### 10.1.3 Lake and Watershed Data

Pools	Surface Elevation (ft.)	Current Capacity (1000)	Surface Area (A)	Shoreline (miles)
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	above m.s.l.)	AF)		
Flood Control	1,057	208.2	13,935	
Multipurpose	1,036	152.1	6,912	101
Total		360.3		

Total watershed area: 349 sq miles (223,360 A)

Watershed ratio: 16.0 FC / 32.31 MP

Average Annual Inflow: 164,670 acre-feet

Average Annual outflow: 000 acre-feet

Sediment inflow (measured): 4,064 acre-feet (1972 – 1985)

## 10.2 2005 Activities

Melvorn Lake was categorized as an ‘ambient’ lake during 2005, thus only surface samples were collected at the three lake sites. Sample collections occurred from May through September, while vertical profiles were recorded at each site during August.

Melvorn Lake staff (OF-ME) providing field sampling assistance during 2005 included Charlie Hall, Jim Franz and Scott Rice. Mack Carlisle, OF-ME Operations Manager, provided insight and background regarding Melvorn Lake.

Our historic water quality data was shared with Paul Ingle, Melvorn Lake watershed coordinator. Discussions included atrazine trends, sedimentation, and watershed activities being promoted by the watershed program.

## 10.3 2005 Data

Comparative historic water quality data consists of monthly (April – September) data collected from 1995 through 2004 / 2005.

### 10.3.1 Inflow

No inflow samples were collected from Melvorn Lake during 2005.

### 10.3.2 Lake

Total nitrogen median concentrations (0.6 – 0.95 mg/L) measured from Melvorn Lake between 1996 and 2005 are some of lowest within the district (Figure 10.2). It should be noted however, these concentrations still exceed EPA’s proposed ecoregional nutrient criteria value of 0.36 mg/L total nitrogen. Nitrogen concentrations are highest in the inflow and typically lowest near the dam. Monthly and annual variability in total nitrogen is evident at all sites, as is depicted in Figure 10.3 for Site 41.

Total phosphorus median concentrations (0.04 – 0.11 mg/L) measured from Melvorn Lake between 1996 and 2005 exceed EPA’s proposed ecoregional nutrient criteria value of 0.02 mg/L (Figure 10.4). Highest concentrations are typically found in the shallow upper lake area.

The ratio of TN:TP can be used as a surrogate to determine the dominant algal community within a waterbody. Ratios  $\geq 20:1$  are indicative of desirable algal

communities, whereas ratios  $\leq 12:1$  are indicative of bloom-forming cyanobacteria (blue green algae). As would be expected, there is high monthly and annual variability in the TN:TP ratio at all sites; see Figure 10.5 as an example at Site 3. Median TN:TP ratios at all three lake sites are  $\sim 12$ , indicating the lake is at risk for cyanobacteria blooms (Figure 10.6).

Mean chlorophyll a concentrations ranged from 8 – 12 ug/L during July and August, 2005. These values, although representing only a single year, are the lowest within the district. Secchi depth measurement during August indicated moderately clear water within the main lake (0.93 – 1.02 m).

Atrazine samples were not collected during 2005. Between 1996 and 2004, median atrazine concentrations (1.1 – 1.7 ug/L) were less than EPA's drinking water maximum contaminant level (MCL) of 3 ug/L (Figure 10.7). However, individual samples measured during that time period are significant enough to exceed the MCL. Figure 10.8 depicts individual sample concentrations measured by date at Site 41, which indicates spikes exceeding the MCL as recent as 2002.

A single vertical profile was recorded at the three lake sites during the 12 August 2005 sampling trip. Parameters included temperature, dissolved oxygen, pH, conductivity, and turbidity. Based on the profile from site 3 (tower), the lake was strongly stratified both chemically and thermally between a depth of 5 – 6m (Figure 10.9).

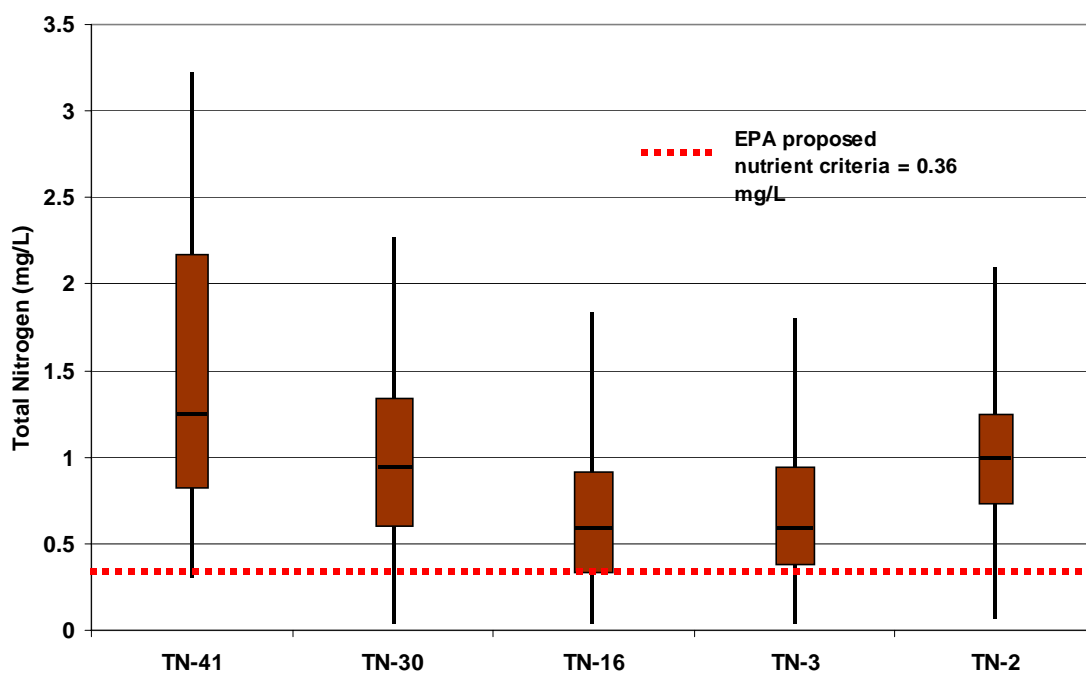


Figure 10.2. Box plots of surface water sample total nitrogen concentrations measured at lake sites from 1996 through 2005 at Melvern Lake.

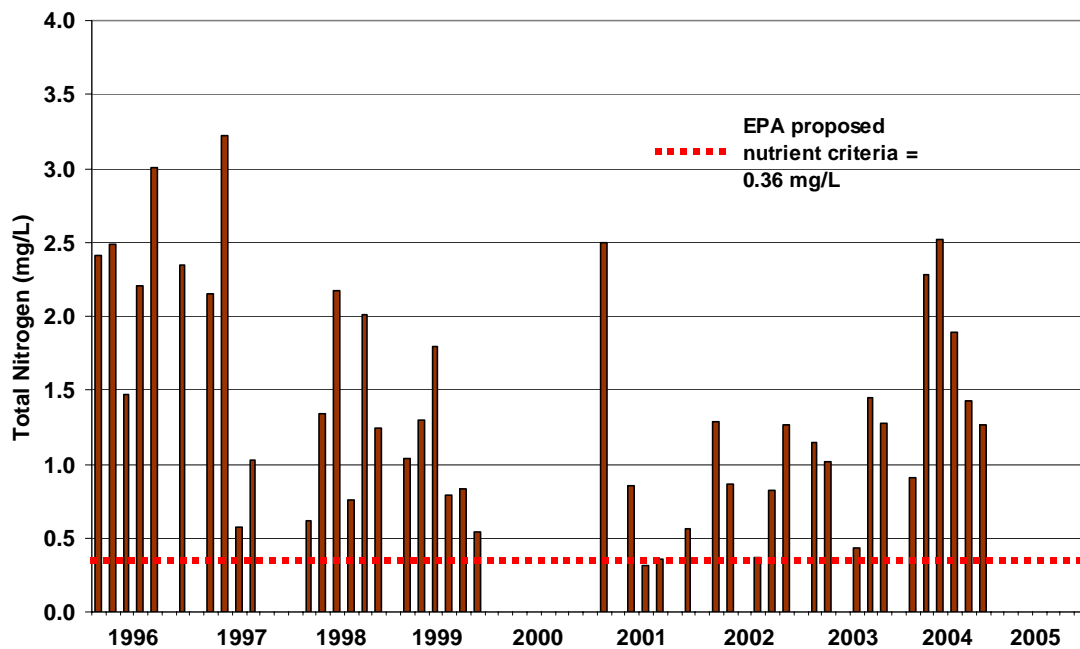


Figure 10.3. Total nitrogen concentrations by sample date from surface water samples collected from Site 41 inflow to Melvern Lake from 1996 through 2004.

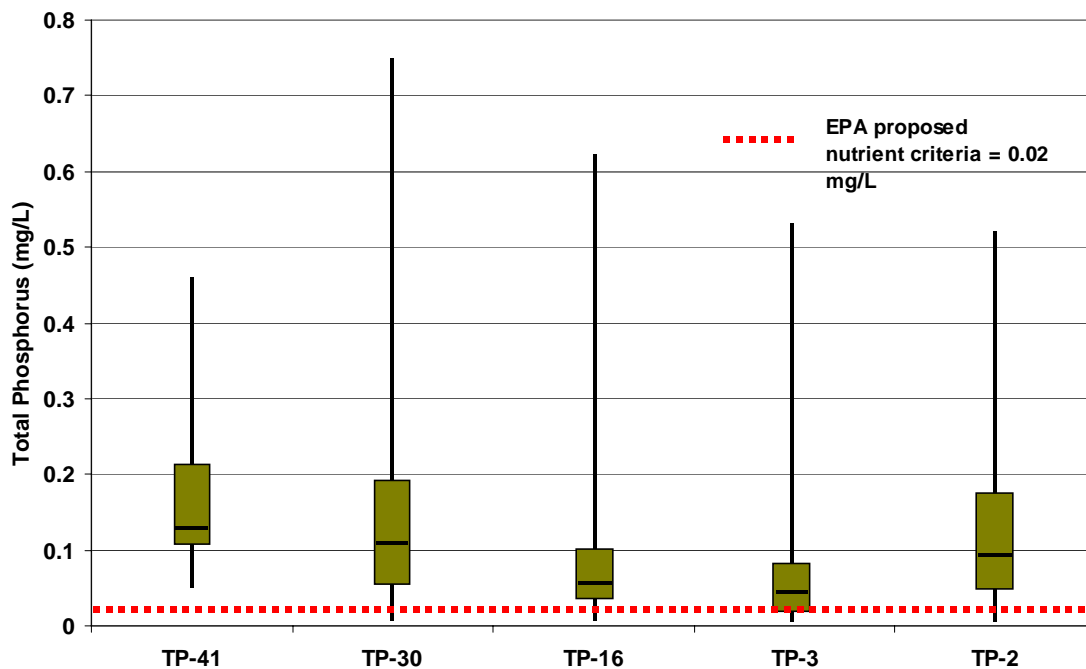


Figure 10.4. Box plots of surface water sample total phosphorus concentrations measured at lake sites from 1996 through 2005 at Melvern Lake.

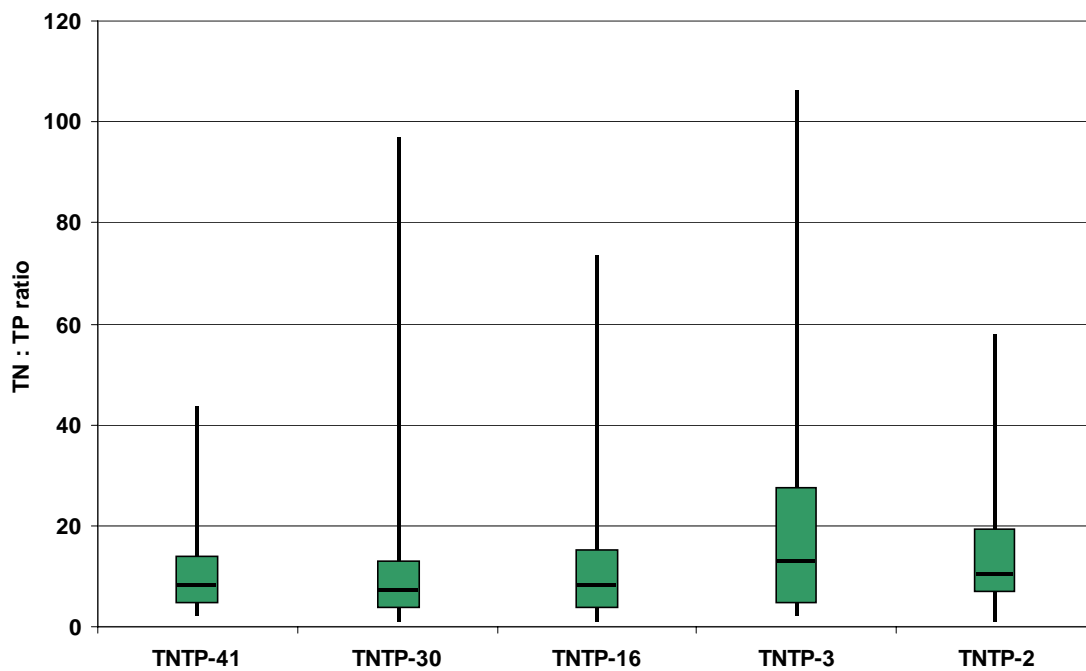


Figure 10.5. Box plots of total nitrogen : total phosphorus (TN : TP) by site from 1996 through 2005 at Melvern Lake.

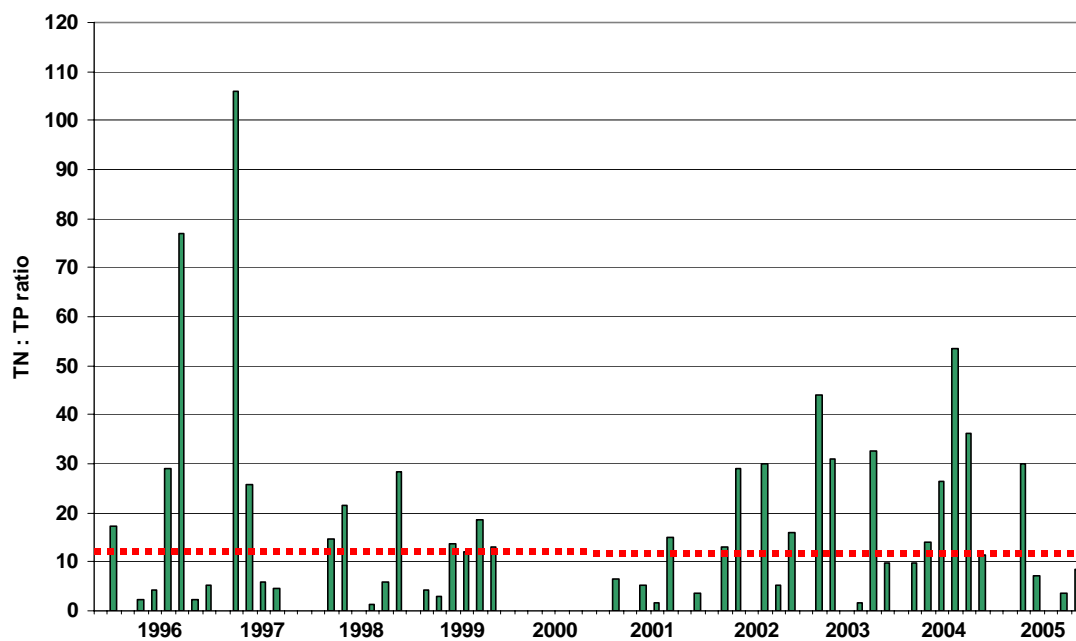


Figure 10.6. Graph of total nitrogen : total phosphorus (TN : TP) ratio by sample date from surface water samples at Site 3 (Tower) of Melvern Lake from 1996 – 2005.

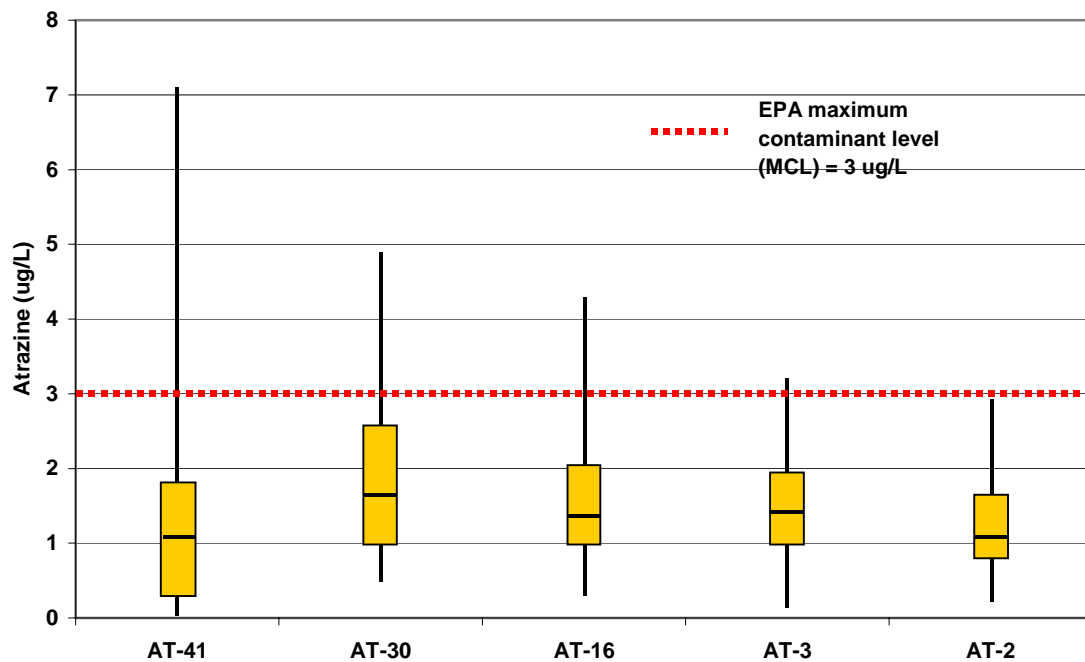


Figure 10.7. Box plots of atrazine concentration by site from 1996 through 2004 at Melvern Lake.

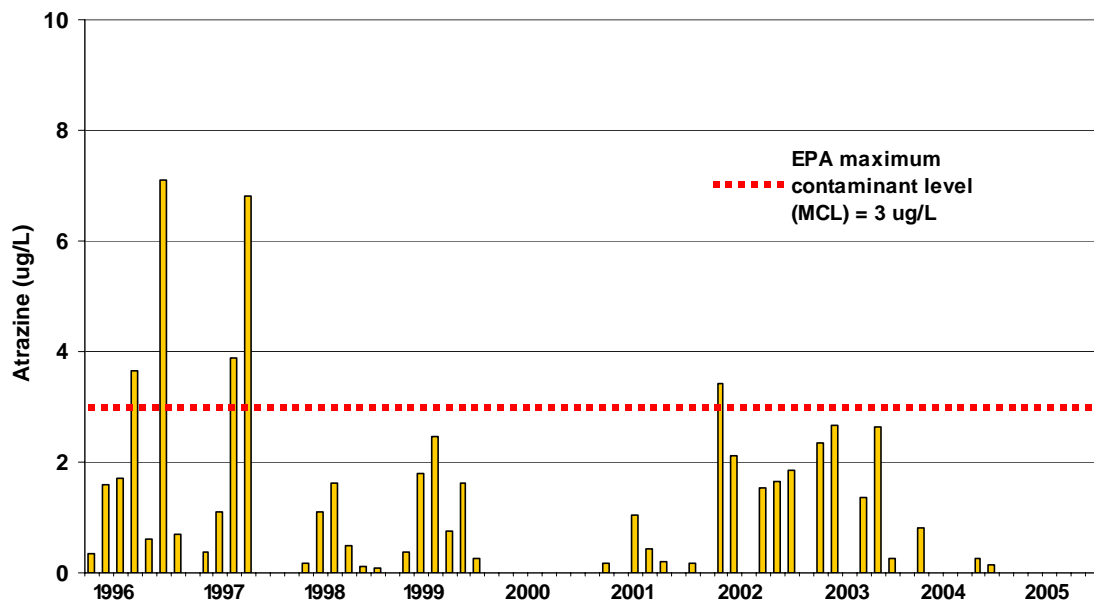


Figure 10.8. Atrazine concentrations by sample date from surface water samples collected at Site 41 inflow to Melvern Lake between 1996 and 2004.

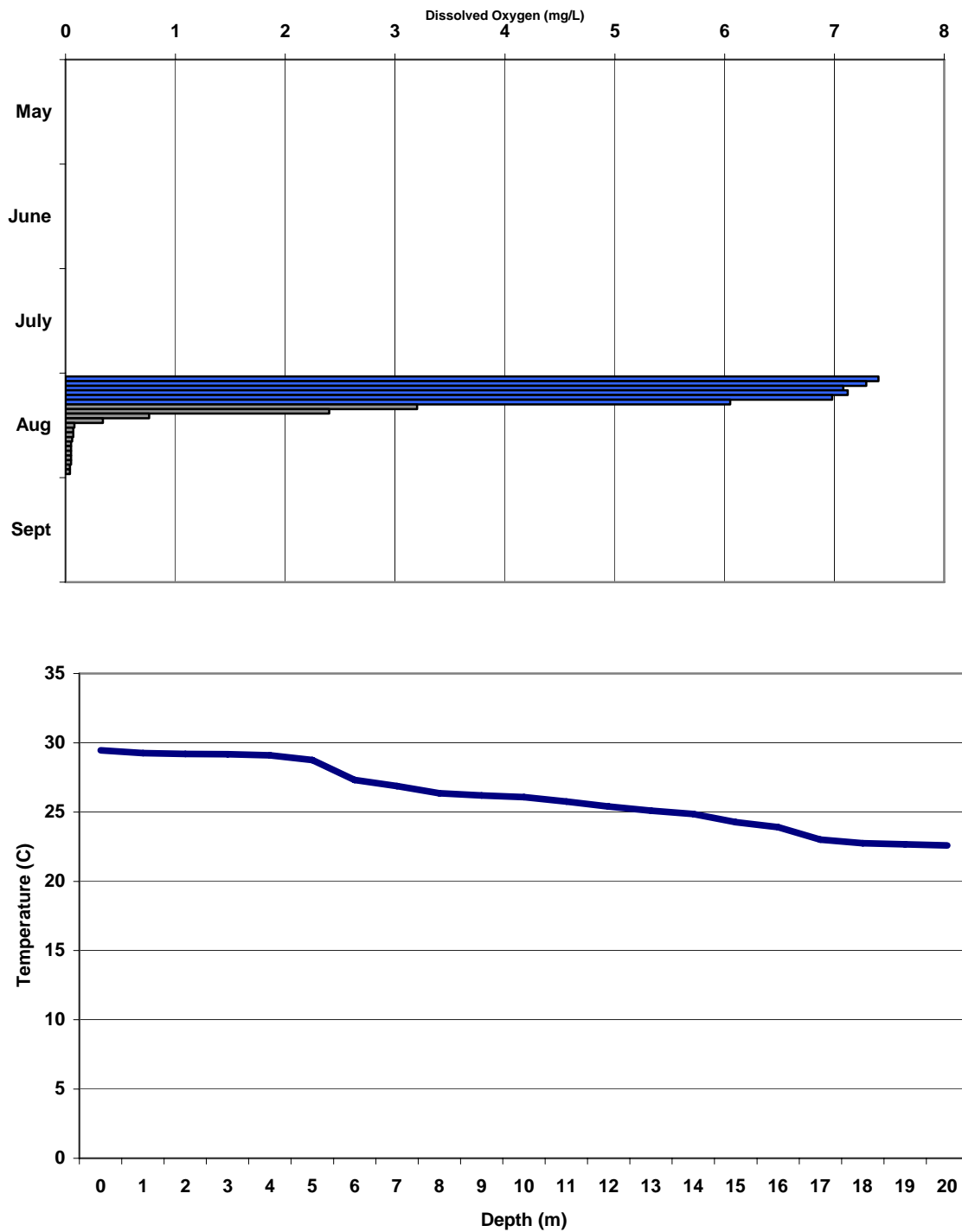


Figure 10.9. Dissolved oxygen concentration (mg/L) histogram and temperature (C) plot from Site 3 on 12 August 2005 at Melvern Lake.

### 10.3.3 Outflow

No outflow samples were collected from Melvern Lake during 2005.

#### **10.4 Future Activities and Recommendations**

Sampling activities for 2006 will include continuation of monthly 'ambient' monitoring from April through September, as well as conducting at least one summer vertical profile at each of the three lake sites. Interactions with Melvern Lake watershed group and Marais des Cygnes basin advisory committee will continue.

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